

CONNECTICUT RIVER BASIN
COLRAIN, MASSACHUSETTS

McLEOD POND DAM
MA 00046

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



The original hardcopy version of this report
contains color photographs and/or drawings.
For additional information on this report
please email

U.S. Army Corps of Engineers
New England District
Email: Library@nae02.usace.army.mil

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

NOVEMBER 1978

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER MA 00046	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) McLeod Pond Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE November 1978
		13. NUMBER OF PAGES 55
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Connecticut River Basin Colrain, Massachusetts		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The McLeod Pond Dam consists of a series of earthen dikes and two concrete structures. The concrete structures are in good to fair condition. The embankments are in fair to poor condition. Based on the size and hazard classification the spillway test flood falls between a 50-year flood and a 100-year flood. The dam and pond are quite small and the potential hazard, in the event of a dam failure, is very low.		

TC 557

.md

MA 46

McLEOD POND DAM, Colrain, MA
MA 00046

C.2

CONNECTICUT RIVER BASIN
COLRAIN, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Identification No.: MA 00046
Name of Dam: McLEOD POND
Town: COLRAIN
County and State: FRANKLIN COUNTY, MA
Stream: MEADOW BROOK
Date of Inspection: 22 August 1978

BRIEF ASSESSMENT

The McLeod Pond Dam consists of a series of earthen dikes and two concrete structures. The concrete structures are the main and auxillary spillways, each of which is positioned between outcrops of ledge. The age of the dam is unknown. Based on the irregularity of the configuration of the dikes and the differences in the concrete structures, it appears that the dam was constructed over a period of years.

The concrete structures are in good to fair condition. The embankments are in fair to poor condition. There are no obvious signs of failure or seepage conditions, especially at the dikes, and low freeboard present at the dikes warrant remedial treatment within a year.

Based on the size and hazard classification in accordance with the Corps of Engineers Guidelines, the spillway test flood falls between a 50-year flood and a 100-year flood. Hydraulic analysis indicates that the spillway will not pass the test flood without overtopping the earth embankments. However, both the dam and pond are quite small and the potential hazard, in the event of a dam failure, is very low.

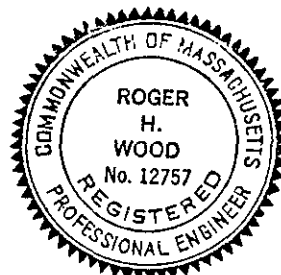
Additional investigations of the seepage at the dikes, the structural stability of the dikes and spillways and the method of providing additional freeboard at the dikes are recommended.

Recommendations for remedial work include the sealing of leakage at the spillways, the providing of erosion protection at the dikes and the clearing of brush and trees from the dikes and downstream channel.

CAMP DRESSER AND MCKEE INC.

Roger H. Wood

Roger H. Wood
Vice President



This Phase I Inspection Report on McLeod Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I Investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the test flood is based on the estimated "probable maximum flood" for the region (greatest reasonably possible storm runoff), or a fraction thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

Table of Contents

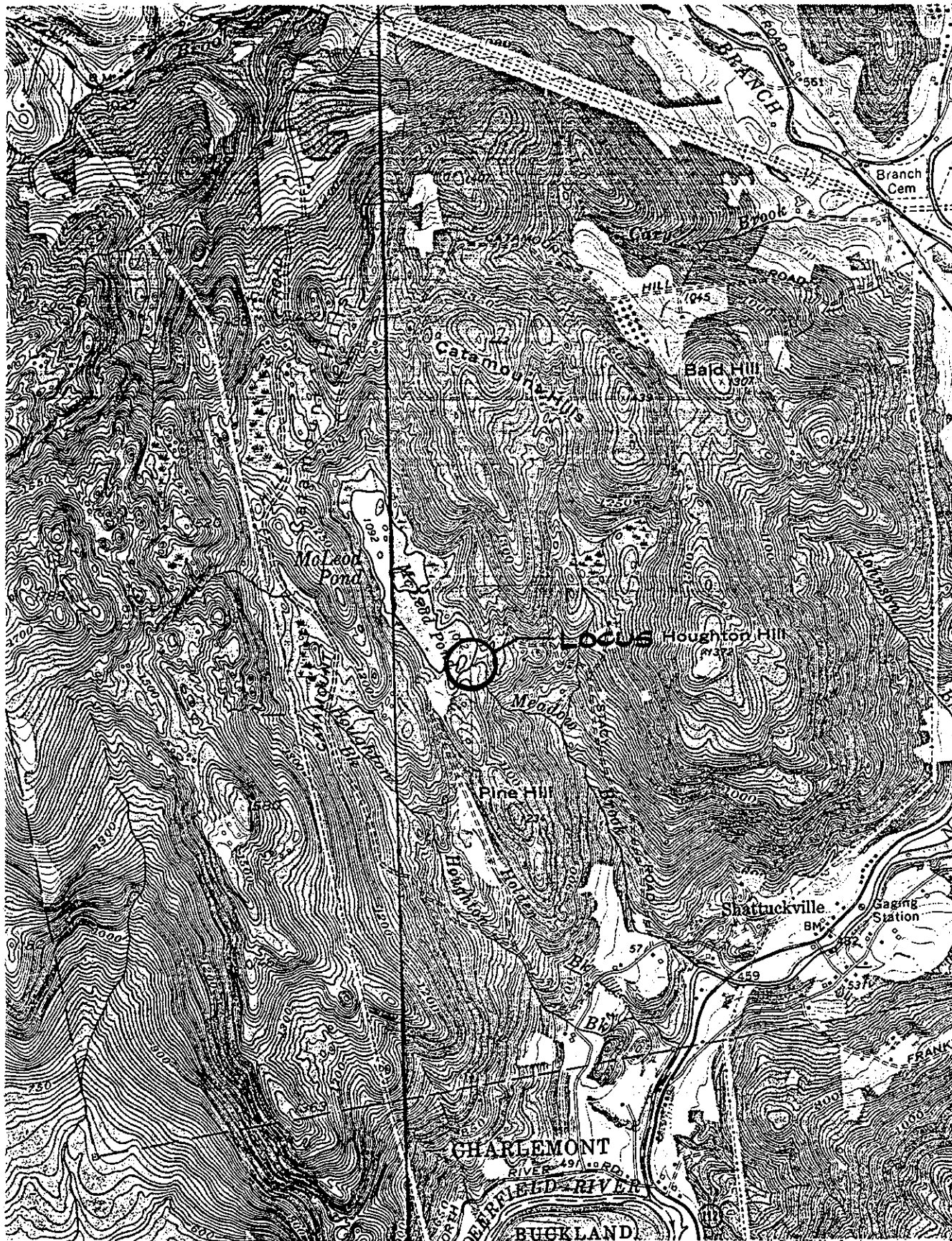
	<u>Page No.</u>
Letter of Transmittal	
Brief Assessment	i
Review Board Signature Sheet	ii
Preface	iii
Table of Contents	iv
Overview Photo	vi
Location Map	vii
 Section 1 - Project Information	
1.1 General	1
1.2 Description of Project	2
1.3 Pertinent Data	4
 Section 2 - Engineering Data	
2.1 Design, Construction and Operation Records	8
2.2 Evaluation	8
 Section 3 - Visual Inspection	
3.1 Findings	9
3.2 Evaluation	11
 Section 4 - Operation Procedures	
4.1 Procedures	12
4.2 Maintenance of Dam	12
4.3 Maintenance of Operating Facility	12
4.4 Description of any Warning System in Effect	12
4.5 Evaluation	12
 Section 5 - Hydraulic/Hydrologic	
5.1 Evaluation of Features	13

Table of Contents (Continued)

	<u>Page No.</u>
Section 6 - Structural Stability	
6.1 Evaluation of Embankment Structural Stability	15
6.2 Evaluation of Spillway Structural Stability	15
Section 7 - Assessment, Recommendations and Remedial Measures	
7.1 Dam Assessment	17
7.2 Recommendations	17
7.3 Remedial Measures	18
7.4 Alternatives	19
Appendix A - Inspection Team Organization and Check List	
Appendix B - List of Available Documents and Prior Inspection Reports	
Appendix C - Selected Photographs of Project	
Appendix D - Outline of Drainage Area and Hydraulic Computations	
Appendix E - Information as Contained in the National Inventory of Dams	



1. OVERVIEW OF DAM, SPILLWAY AND FOOTBRIDGE FROM
RIGHT ABUTMENT



DAM: McLEOD POND

IDENTIFICATION NO.: MA.00046



LOCATION MAP
USGS QUADRANGLE
HEATH & COLRAIN, MA, VT.
SCALE: 1" = 2000'

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
McLEOD POND DAM
MA 00046

SECTION 1: PROJECT INFORMATION

1.1 General

- a. Authority - Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region.

Camp Dresser & McKee Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued to Camp Dresser & McKee Inc. under a letter of July 12, 1978, from Colonel John P. Chandler, Corps of Engineers. Contract No. DACW 33-78-C-0354 has been assigned by the Corps of Engineers for this work. Haley and Aldrich, Inc. has been retained by Camp Dresser & McKee Inc. for the soils and geological portions of the work.

- b. Purpose - The primary purpose of the investigation is to:
- (1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
 - (2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.
 - (3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

- a. Location - McLeod Pond Dam is located in Catamount State Forest, Colrain, Massachusetts, as shown on the report's Location Map. McLeod Pond forms the headwaters of Meadow Brook which discharges to the North River; the North River is tributary to the Deerfield River. The dam is located along the southern end of the pond.
- b. Description of Dam and Appurtenances - The dam site consists of a series of rock outcroppings with four earth embankments and two

concrete spillways extending along approximately a 700 ft. length of the southerly shoreline of the pond. The combined length of earth dike is approximately 200 ft. Sketch plan and sections prepared from the field inspection are shown in Appendix C. There are no gates or regulating outlets at the dam site.

The most westerly dike spans approximately 106 feet between high ground on the westerly side and a rock outcrop with topsoil on the easterly end. The top width is about 4 to 5 feet at an estimated elevation of 1094.5. The dike has a maximum height of 4 ft. and the water surface elevation during inspection was about 2 feet below the top of dike. Water depths adjacent to the dike are from 1 to 2 feet. Ponded water on the downstream side was only about 0.1 ft. lower than the Pond level at the time of the inspection. The dike appears to have been constructed of ordinary earth fill with irregularly steep side slopes. Approximately 40 ft. of the upstream face at the east end of this dike section has a facing of rotted 1 1/2-in. thick tongue and groove boards. For discussion purposes, this embankment will be called Dike 1.

The next filled area located east of Dike 1 is a saddle between two rock outcrops which is approximately 10 feet long. The top elevation was estimated to be about 1094.5 with the water surface about 2 feet lower. This section has a similar shape as Dike 1 and will be referred to as Dike 2. The rock outcrops between Dikes 1 and 2 are approximately 10 to 12 ft. above the water elevation.

East of Dike 2 is the main spillway which consists of a 1'-6" thick crest concrete wall spanning a rock gorge. The length of the concrete spillway is about 12'-6" with a 6 foot long rectangular notch 1'-4" down from the top of the wall. The crest elevation of the notch is 1092.0. A flashboard, approximately 7 inches high, is located on top of the spillway crest. The approach to the spillway is filled with sediment up to the spillway crest. Approximately 20 feet upstream, water depths of about 8 feet where measured.

Farther east, beyond the spillway, there is another narrow earth dike approximately 63 ft. long. It has a maximum height of approximately five feet relative to a parallel swale that extends along most of the downstream side. Beyond the swale the ground rises to a ridge of rock that is about at the level of the dike. On the downstream side of the ridge there is a steep slope down to the rocky outlet channel below the spillway. This dike has a 5 to 6 ft. minimum crest width, irregularly steep side slopes, and upstream slope protection in the form of random boulders. The top elevation was estimated to be about 1093.7. Water depths adjacent to this section range from 1 to 2 feet. This section will be referred to as Dike 3.

East of Dike 3 and spanning two rock outcrops is a 22-foot long concrete wall with an estimated crest elevation of 1094.0. The downstream face of the concrete wall is vertical with a maximum height of about 3 feet. The upstream face is sloped thus approximating a sharp crested weir. The pond elevation is approximately 18 inches below the weir crest and the maximum approach depth was measured to be about 4 feet. This structure will be referred to as the auxillary spillway.

The last man-made portion of the McLeod Pond Dam is located east of the auxillary spillway between two rock outcrops. The 43 foot long embankment had been recently worked on and the new fill material was a relatively clean gravelly sand, which sloped down steeply at its angle of repose to form unprotected upstream and downstream faces of the dike. The first 18 feet of the westerly end has a partially buried concrete wall on the upstream face spanning between ledge outcrops. The dike crest width is approximately 18 feet at an estimated elevation of 1094.5. Water depths adjacent to the dike were about 1 to 2 feet with a maximum depth of 4 feet about 25 feet out in the pond. This dike will be referred to as Dike 4 for discussion purposes.

The main discharge channel leaving the main spillway is a gorge approximately 10 to 12 feet deep in rock with an estimated average width of 3 feet. Downstream of each of the four dikes and the auxillary spillway are combinations of small gorges and marsh areas which wind around in between rock outcrops and eventually join the main discharge channel which forms Meadow Brook.

- c. Size Classification - McLeod Pond Dam has a maximum height of about 10 feet at the main spillway and an estimated storage capacity of 270 acre-feet at the top of dam. According to guidelines established by the Corps of Engineers, the dam is classified in the small category.
- d. Hazard Classification - The dam has been classified by the Corps of Engineers as having a "low" hazard potential. Based on results of the overtopping potential analysis (Section 5.1d) as well as the dam failure analysis (Section 5.1e), it is recommended that this "low" classification be retained. As discussed in Section 5.1, there is no development or significant agricultural land which would be damaged in the event of a dam failure. The only probable damage that would occur along Meadow Brook between the dam site and the North River is to two country bridges. No hazards exist downstream of the confluence of Meadow Brook with the North River.

- e. Ownership - The dam and pond are located within Catamount State Forest and are owned by the Commonwealth of Massachusetts. The owner is represented by Kenneth M. Dubuque, Regional Supervisor, Box 484, Amherst, MA 01002 (Phone: 413/549-1461).
- f. Operator - Mr. Roger Ward, Acting Senior Forest & Park Supervisor, is assigned responsibility for the operation and maintenance of the dam. His address is: Monroe State Forest, Box 169, Charlemont, MA 01339 (Phone: 413/424-7600).
- g. Purpose of Dam - The pond is used for recreational purposes and is regulated by the Department of Environmental Management, Division of Forests and Parks.
- h. Design and Construction History - There are no records of the design or construction of this dam. Discussions with local residents indicate that the pond was created by the construction of dikes between natural rock outcrops during the early 1900's by W. Crouch who owned the land at that time. Prior to the creation of the pond, the area is reported to have been a meadow. Ownership of the land was transferred to E. H. McLeod after whom the pond is referred to today.

Dike work is reported to have been done in the late 1940's, details of which are not available. At the time of inspection, freshly placed fill was observed at the toe of the auxillary spillway and on top of Dike 4.
- i. Normal Operational Procedure - Operational procedures consist of removing the flashboards on the main spillway in the fall and replacing them in the spring. Debris is periodically removed from the upstream face of the spillway when observed.

1.3 Pertinent Data

There are no known elevations previously established at the dam site. Consequently, the water surface elevation of 1092 shown on the USGS Quadrangle, Colrain, Mass.-Vt., 1961, was adopted as being the crest elevation of the 6'-0" x 1'-4" notch in the main spillway. All other elevations given in this report were estimated from the water-surface elevation of the pond at the time of the inspection.

- a. Drainage Area - The drainage area tributary to the dam site is 409.6 acres or 0.64 square miles of which McLeod Pond is 36.7 acres or 9 percent of the total watershed. The topography of the drainage area is very steep with average side slopes at 25 percent grade. The entire terrain is thickly forested with the exception of one small swampy area located to the northwest of the pond having an area of approximately 12 acres.
- b. Discharge at Dam Site - There are no records of discharges for McLeod Pond Dam. Record rainfalls of 10 inches over a five day period occurred in September, 1938, and again in October, 1955.
 - (1) Outlet works _____ NONE
 - (2) Maximum known flood at damsite _____ UNKNOWN
 - (3) Ungated spillway capacity at top of dam.
76 cfs @ 1,094.45 elev.
 - (4) Ungated spillway capacity at test flood pool elevation
96 cfs @ 1,094.70 elev.
 - (5) Gated spillway capacity at normal pool elevation _____ N/A
 - (6) Gated spillway capacity at test flood pool elevation _____ N/A
 - (7) Total spillway capacity at test flood pool elevation
96 cfs @ 1,094.70 elev.
 - (8) Total project discharge at test flood pool elevation
370 cfs @ 1,094.70 elev.
- c. Elevation (ft. above MSL)
 - (1) Top of dam _____ 1,094.45 (Est.)
 - (2) Test flood pool-design surcharge _____ 1,094.70 (Est.)
 - (3) Design surcharge-original design _____ UNKNOWN
 - (4) Full flood control pool _____ N/A
 - (5) Recreation pool _____ 1,092.0 (Est.)
 - (6) Spillway crest _____ 1,092; 1092.58 with flashboards

- (7) Upstream portal invert diversion tunnel _____ N/A
 (8) Streambed at centerline of dam _____ 1,084.0 (Est.)
 (9) Maximum tailwater _____ Below Spillway Crest

d. Reservoir

- (1) Length of test flood pool _____ 3,400 ft. (Est.)
 (2) Length of recreation pool _____ 3,200 ft. (Est.)
 (3) Length of flood control pool _____ N/A

e. Storage (acre-feet)

- (1) Top of dam _____ 270 (Est.)
 (2) Test flood pool _____ 275 (Est.)
 (3) Flood-control pool _____ N/A
 (4) Recreation pool _____ 165 (Est.)
 (5) Spillway crest _____ 165 (Est.)

f. Reservoir Surface (acres)

- (1) Top of dam _____ 42.8 (Est.)
 (2) Test flood pool _____ 43.4 (Est.)
 (3) Flood control pool _____ N/A
 (4) Recreation pool _____ 36.7 (Est.)
 (5) Spillway crest _____ 36.7 (Est.)

g. Earth Dikes

	<u>Dike 1</u>	<u>Dike 2</u>	<u>Dike 3</u>	<u>Dike 4</u>
(1) Type	All are earth embankments.....			
(2) Length	Approx. 100 ft.	Approx. 10 ft.	Approx. 70 ft.	Approx. 25 ft.
(3) Height	Approx. 3 ft.	Approx. 4 ft.	Approx. 5 ft. above natural ground	Less than 5 ft. to natural slope

SECTION 2: ENGINEERING DATA

2.1 Design, Construction and Operation Records

No records pertaining to the design, construction or operation of the McLeod Pond Dam were located and none are believed to exist.

2.2 Evaluation

Since no engineering records are available, the evaluation of the dam must be based primarily on the results of the visual examination which is detailed in Section 3.

SECTION 3: VISUAL INSPECTION

3.1 Findings

- a. General - The visual examination of McLeod Pond Dam was conducted on 22 August 1978.

In general, the masonry portions of the dam were found to be in good to fair condition and the embankment portion of the dam was found to be in fair to poor condition. The main spillway and auxillary spillway concrete was found to be in good condition but some seepage was noted at the structures. The dike embankments were found to be in poor condition due to the irregularities in dike cross section, the lack of sufficient freeboard and the presence of seepage.

A visual inspection checklist is included in Appendix A and selected photographs of the project are given in Appendix C.

- b. Dam - The main spillway concrete was noted to be in good to fair condition. The surface of the concrete appears to have softened. The joints in the concrete have started to deteriorate and there is efflorescence on the left side of the structure. Seepage is occurring on the right side where the structure abuts the rock outcrop. The spillway is shown in Photo Nos. 2 and 3. The area immediately downstream of the concrete weir is a rock gorge as shown in Photo No. 4. This area has a major amount of debris present in the form of twigs, branches and young trees. There is some tree growth within the gorge itself.

The auxillary spillway concrete was found to be in good condition. A vertical crack was observed on the right side of the wall and several spalls were present on the downstream face. Seepage was observed at the base of the wall. A small reinforcing bar projects 3 inches above the crest of this structure. No special import is given to the projecting reinforcing bar. The auxillary spillway is shown in Photo No. 12.

The remains of what appears to be an old concrete dam is incorporated in Dike No. 4 on the right hand side upstream face. This wall extends between two rock outcrops. The concrete has horizontal and vertical fractures in it. Although the concrete is in poor condition, its present usage appears to be as upstream face protection for this portion of the dike. The condition of the concrete therefore, has no particular rating at this location. The wall at Dike No. 4 is shown in Photo No. 13.

The earth dike embankments are generally in fair condition. The irregular configuration of the dikes obscures visual evidence of

settlement or lateral movement, but there is evident seepage and local erosion at the westerly dike (Dike 1) and there are obvious deficiencies in each dike cross section.

Seepage was present at Dike No. 2 during the time of the site examination. Several planks had been placed in the area to allow foot traffic over the wet loose ground. Dike No. 2 is shown in Photo No. 10.

The following specific items were noted:

- (1) Ponded water downstream from the westerly dike (Dike 1) appears to result from seepage through or under the dike, possibly related to the rotted wood facing shown in Photo No. 9. Flow, estimated at a few gallons per minute, exits from the shallow downstream pond over a topographic constriction and continues to a junction with the outlet channel (Photo No. 6).
- (2) A notch, roughly 18 in. deep, has been cut into the downstream face at one location on the left side of Dike 1. This may be erosion due to overtopping during high water.
- (3) All of the earth dikes have limited freeboard and irregular alignment resulting in susceptibility to concentrations of overtopping flow during high water, which would cause local erosion.
- (4) The westerly and central dikes (Dikes 1 and 3) have a varied growth of grass, weeds, brush and trees on the crest and slopes, as shown in Photos No. 7, 8, 9 and 11.
- (5) The westerly dike (Dike 1) with its partially rotted board facing, and the easterly dike (Dike 4) with the new fill shown in Photo No. 13, lack erosion protection on the upstream slope.
- (6) Except for the easterly dikes, there is presently no route for vehicular equipment access to the project in the event that repairs are necessary.
- (7) Seepage at Dike No. 2 has saturated an area of ground at this dike.

- c. Appurtenant Structures - The bridge over the main spillway is in good condition. The timber rails, decking and stringers have been well maintained.
- d. Reservoir Area - The area around McLeod Pond is heavily wooded and completely undeveloped. Side slopes to the pond are moderate to steep. However, no significant potential for landslides into the pond were observed which could create waves that might overtop the dam. Since the pond is located within Catamount State Forest where development is prohibited, it is highly unlikely that any sudden increase in sediment load into the pond would occur. However, it was noted at the time of inspection that a fair amount of sediment has built-up behind the spillway.
- e. Downstream Channel - The average slope of Meadow Brook (Photo No. 5) as it flows from McLeod Pond to the North River is approximately 0.114 which is quite steep. Consequently it is highly unlikely that the tailwater would ever flood-out the spillway. There is no development along Meadow Brook between McLeod Pond and the North River.

3.2 Evaluation

Except for the recent fill placement at the easterly dike (Dike 4), it appears that there has been little or no work to maintain or improve the embankments at McLeod Pond Dam, and there are deficiencies in the embankments which should be corrected. Based on the visual examination, there appears to be significant potential for dam failure under conditions of high water levels and/or sustained wave action.

SECTION 4: OPERATIONAL PROCEDURES

- 4.1 Procedures - In general, there is no established routine for the operation of the dam.
- 4.2 Maintenance of Dam - There are no established formal maintenance programs for this structure. Debris is periodically removed from the spillway when observed.
- 4.3 Maintenance of Operating Facilities - There are no operating facilities for this dam. The flashboards are removed each winter and replaced each spring.
- 4.4 Description of any Warning System in Effect - There is no established warning system or emergency preparedness plan in effect for this structure.
- 4.5 Evaluation - A periodic observation and maintenance program should be established for this structure to examine the dam, control tree and brush growth, and maintain slopes and structural walls. The facility should be inspected during periods of unusual high rainfall.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

- a. Design Data - No hydraulic/hydrologic design data is available concerning this dam.

Based upon the Corps of Engineers guidelines, the recommended test flood for the size (small) and hazard potential (low) is within the range of the 50-year to 100-year recurrence interval.

- b. Experience Data - An estimate of the test flood range was made using a method developed by the Soil Conservation Service (SCS) which requires the development of a unit hydrograph for the watershed. The effect of the hydrologic soil-cover complex on the amount of rainfall that runs off is represented by a runoff curve number, referred to as CN. A CN value of 60 was adopted for the McLeod Pond Watershed. Application of this method resulted in a 50-year test flood inflow of 437 cfs and a 100-year inflow of 536 cfs.

The 100-year inflow was also determined using an empirical relationship developed by the Corps of Engineers whereby the 100-year test flood is assumed to be equal to 1/4 the probable maximum flood (PMF). Curves developed by the Corps of Engineers for estimating the PMF were extrapolated to obtain values for small drainage areas (less than 2.0 square miles). Based on mountainous terrain, a peak inflow rate of 2,950 csm was selected which results in a 100-year peak inflow of 470 cfs. This value compares reasonably well with the results of analysis using the SCS method. Consequently, the value of 470 cfs, which is mid-range between the 50-year and 100-year values developed by the SCS method, was adopted as the test flood inflow. After surcharge storage routing, the test flood outflow at the McLeod Pond Dam was determined to be 370 cfs at a discharge elevation of 1,094.7 or approximately 3 inches above the top of Dikes 1, 2 and 4.

- c. Visual Observations - In general, the layout and construction of the dam site appears to have been done without any detailed design. While the crest elevation of the auxiliary spillway is below the top of Dikes 1, 2 and 4, it is higher than the top of Dike 3.

At the time of inspection, a considerable amount of reeds and small brush were accumulated both upstream and downstream of the main and auxiliary spillways. This debris is apparently the result of beavers and if not periodically removed, could affect the hydraulic capacities of these structures.

- d. Overtopping Potential - The maximum spillway capacity was computed on the assumption that the 7-inch flashboard would remain in place. This was assumed as there is no provision for its removal during periods of high flows and since it is constructed of four 2 x 4's nailed together and appears to be quite durable, it is not expected to be washed out by the relatively low heads that would result during an occurrence of the test flood. On the basis of the foregoing assumption, the maximum spillway capacity with the water surface at elevation 1,093.7 (top of Dike No. 3) is 28 cfs. Since the test flood is 370 cfs, the spillway is capable of passing only 8 percent of the test flood with the pool elevation at the top of Dike 3. If the top of Dike 3 were raised to elevation 1,094.45 (same as dikes 1, 2 and 4), the combined capacities of both the main and auxiliary spillways would be 98 cfs at elevation 1,094.45 or 26 percent of the test flood.
- e. Evaluation - Peak failure outflows were determined for a 40 percent breach width of Dike 4 and a complete failure of the main spillway. The resulting outflows were computed to be 570 and 470 cfs respectively. Using a conservative Manning's "n" value of 0.08 for Meadow Brook, a peak discharge of 570 cfs would result in a depth of flow of about 4.7 feet at a top width of approximately 24 feet. At this stage there is no development nor agricultural lands which would be affected along Meadow Brook. The North River, which would receive the peak failure outflow of 570 cfs, experiences normal flows in excess of this amount at least once per month. Therefore, no hazards appear to exist, other than damage to two small bridges which cross Meadow Brook.

In conclusion, while the spillway is inadequate to pass the test flood, the potential hazard in the event of a dam failure is considered low.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Embankment Structural Stability

- a. Visual Observation - There was no visible evidence of dike embankment instability during the site examination on 22 August 1978. The narrow irregular crests and the varying side slopes result in dike cross sections that are generally smaller than would be provided by usual design practice. However, the dike heights and water depths are also less than would usually be encountered in design practice, and may not warrant a full width section.

While there was ponded water and slight flow on the downstream side of the westerly dike (Dike 1), there was no indication of piping or active erosion along the dike. Therefore, the apparent seepage is not considered to pose an immediate hazard to the stability of the westerly dike. It should also be noted that the dike embankments are only a few feet high. Where there is seepage at Dike 1, the nearly equal upstream and downstream water levels result in a low hydraulic gradient through the embankment.

- b. Design and Construction Data - As far as is known, there is no available design information on the McLeod Pond Dam embankments; the irregular geometry indicates that there may well have been no formal design. There is also no construction data which would indicate the physical properties of the earth fill in the embankments.
- c. Operation Records - There are no known operating records available for the dam.
- d. Post-Construction Changes - The only known post-construction change to the embankments is the recent placement of gravelly sand fill in the area of the easterly dike (Dike 4). The relatively pervious new fill now apparently covers whatever less pervious embankment material there may have been in the original dike.
- e. Seismic Stability - McLeod Pond Dam is located in Seismic Zone No. 2 and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

6.2 Evaluation of Spillway Structural Stability

- a. Visual Observations - There was no evidence that movement or distress in the main spillway or auxillary spillway concrete has taken place.

- b. Design and Construction Data - There are no known design and construction data for the spillways. A theoretical structural analysis of the spillways was not possible due to the lack of pertinent data. The stability of the spillways must be based, therefore, on the visual observations made during the site examination. The present condition of the spillways after an estimated 30 or more years of operation indicates the spillways are currently stable.
- c. Operation Records - No operating records are known to exist for the spillways.
- d. Post-Construction Changes - There are no known records or visual indication that post-construction changes have been made to the spillways.
- e. Seismic Stability - The structures are located in Seismic Zone No. 2 and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. Condition - The visual examination of the McLeod Pond Dam embankments did not reveal any evidence of failure, but it did disclose an apparent potential for overtopping by high water or wave action. The project is considered to be generally in poor condition because of the inadequacies in the geometry of the dikes.

The spillways are in good to fair condition. Seepage is present at the base of the spillways and at the right side of the main spillway. Local deteriorated areas in the form of deteriorated joints, efflorescence and spalled areas were noted during the site examination. It is estimated that the spillways are structurally stable, however, sufficient data is not currently available to perform a theoretical analysis.

The spillways cannot pass a spillway test flood. The recommended test flood for this dam is between a 50-year flood and a 100-year flood. The test flood outflow at McLeod Pond Dam was determined to be 370 cfs. A discharge of this magnitude would overtop Dikes 1, 2 and 4.

- b. Adequacy of Information - Since there were no available drawings, all information for the Phase I Investigation has had to be obtained from visual examination and limited measurements at the site. This information has been sufficient for the purpose of this investigation, but it does not permit detailed evaluation of stability or seepage.
- c. Urgency - The recommended additional investigations and remedial measures outlined in Sections 7.2 and 7.3, respectively, should be undertaken by the owner within one year after receipt of this report.
- d. Need for Additional Investigations - Additional investigations should be performed by the Owner as outlined in the following section.

7.2 Recommendations

It is recommended that the owner engage a registered professional engineer to undertake the following investigations:

1. Topographic survey of dike embankments, including adjacent ground surface above and below water upstream and downstream, to permit evaluation of the actual dike configurations. Trees and stumps in the embankments should be individually located.

2. An investigation of the seepage occurring at the westerly dike (Dike 1), including test borings through the embankment. For purposes of this investigation, the survey under 1 above should include the area of ponded and flowing water on the downstream side of the dike.
3. An evaluation of actual dike configurations to determine whether or not there is a need to make substantial dike improvements. The design of such improvements should include test borings through the various embankments; it may be practicable to do the test boring work as part of the Dike 1 seepage investigation, 2 above.
4. An investigation should be made to determine the actual configuration of the spillways. The data obtained should be sufficient to perform a theoretical analysis of the structural stability of the spillways.
5. An investigation leading to the modification of all dikes to provide adequate freeboard.

7.3 Remedial Measures

- a. Operation and Maintenance Procedures - It is recommended that the following remedial work be undertaken by the Owner, in addition to the investigations outlined in Section 7.2, to correct deficiencies noted during the visual examination:
 1. Clear brush and trees, including stump removal and back-filling, and cut grass and weeds on the embankments at least once a year.
 2. Provide erosion protection where it is lacking or deficient on the upstream faces of the dikes. Repair the eroded notch in the westerly dike (Dike 1).
 3. Improve and maintain access to the various dikes.
 4. Plug, as much as possible, the leaks at the spillways between the concrete structure and the ledge outcrops.

Due to the condition of this dam, surveillance should be provided by the owner during and following periods of unusually heavy precipitation. The owner should also develop a formal emergency procedures plan and warning system, in cooperation with local officials in downstream communities.

It is also recommended that the owner establish a formal program to annually inspect the dam and to provide for routine maintenance. Responsibility for the activity should be assigned to one person or to a board reporting directly to the Department of Environmental Management.

7.4 Alternatives

In lieu of performing the investigations as stated above and the remedial measures stated below, a portion of the dam such as the main spillway can be removed. At present, this pond serves only recreational use. The poor access to this pond limits the general use of the facility by the public.

APPENDIX A

INSPECTION TEAM ORGANIZATION AND CHECK LIST

Page No.

VISUAL INSPECTION PARTY ORGANIZATION

A-1

VISUAL INSPECTION CHECK LIST

Dike 1
Dike 2
Main Spillway
Dike 3
Auxillary Spillway
Dike 4
Hydrologic-Hydraulic Considerations
Field Inspection Sketches (2 pages)

A-2
A-3
A-4
A-5
A-6
A-7
A-8
A-9

VISUAL INSPECTION PARTY ORGANIZATION
NATIONAL DAM INSPECTION PROGRAM

DAM: McLeod Dam

DATE: August 22, 1978

TIME: 8:30 a.m.

WEATHER: Clear, calm, 60° F - 70° F

WATER SURFACE ELEVATION UPSTREAM: 1-1/2" below top of 7" flashboard.

STREAM FLOW: < 1 cfs

INSPECTION PARTY:

- | | |
|---|-------|
| 1. <u>Roger H. Wood</u> | } CDM |
| 2. <u>Joseph E. Downing</u> | |
| 3. <u>Charles E. Fuller</u> | |
| 4. <u>Peter LeCount - Haley & Aldrich</u> | |
| 5. _____ | |
| 6. _____ | |

PRESENT DURING INSPECTION:

1. Maintenance Crew from Dept. of Environmental Management
2. _____
3. _____
4. _____

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: McLeod Pond

DATE: 8/22/78

EMBANKMENT: Dike 1

CHECK LIST	CONDITION
1. Upstream Slope a. Vegetation b. Sloughing or Erosion c. Rock Slope Protection - Riprap Failures d. Animal Burrows	1. a. Grass, weeds, ferns b. Steep, w/rotted boards & local few inches earth overhang. c. No riprap (boards along approx. 40' of length) d. None observed
2. Crest a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Movement or Settlement	2. a. Weeds, grass & moss along edges b. None observed c. None observed d. Slightly irregular, no obvious movement or settlement.
3. Downstream Slope a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Animal Burrows e. Movement or Cracking near toe f. Unusual Embankment or Downstream Seepage g. Piping or Boils h. Foundation Drainage Features i. Toe Drains	3. a. 2 trees, brush, weeds, grass b. Local notches, one approx. 18" into slope c. None observed d. None observed e. None observed f. Water level downstream approx. 0.1" lower than upstream, with slight meandering flow thru irreg. swale toward spillway discharge chan. g. None observed h. None observed i. None observed
4. General a. Lateral Movement b. Vertical Alignment c. Horizontal Alignment d. Condition at Abutments and at Structures e. Indications of Movement of Structural Items f. Trespassing g. Instrumentation Systems	4. a., b., c. Dike irregular, but no indication of movement, max. crest irregularity $\approx 6"$. d. Gradual merging w/higher ground at abutments (no struct.). e. N.A. f. Path used along crest. g. None observed.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: McLeod Pond

DATE: 8/22/78

EMBANKMENT: Dike 2

CHECK LIST	CONDITION
1. Upstream Slope a. Vegetation b. Sloughing or Erosion c. Rock Slope Protection - Riprap Failures d. Animal Burrows	1. a. Pond extends to dike - minor growth in water. b. None observed c. None observed d. None observed
2. Crest a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Movement or Settlement	2. a. Brush and grass b. None observed c. None observed d. None observed
3. Downstream Slope a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Animal Burrows e. Movement or Cracking near toe f. Unusual Embankment or Downstream Seepage g. Piping or Boils h. Foundation Drainage Features i. Toe Drains	3. a. Marsh grass b. None observed c. None observed d. None observed e. None observed f. Area moist bordering on saturation, planks in place for foot traffic. g. None observed h. None observed i. None observed
4. General a. Lateral Movement b. Vertical Alignment c. Horizontal Alignment d. Condition at Abutments and at Structures e. Indications of Movement of Structural Items f. Trespassing g. Instrumentation Systems h. Other	4. a. Good b. Good c. Good d. Good e. No movement observed f. None observed g. None observed h. Seepage is present as evidenced by 3f. probably on rock-soil interface therefore condition considered fair.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: McLeod Pond

DATE: 8/22/78

SPILLWAY: Main Spillway

CHECK LIST	CONDITION
1. Approach Channel a. General Condition b. Obstructions c. Log Boom etc.	1. a. Good condition b. Silt grass c. None present
2. Weir a. Flashboards b. Weir Elev. Control (Gate) c. Vegetation d. Seepage or Efflorescence e. Rust or Stains f. Cracks g. Condition of Joints h. Spalls, Voids or Erosion i. Visible Reinforcement j. General Struct. Condition	2. a. Good but waterlogged b. None c. N/A d. Efflorescence on left side; seepage at Rt. side abut. joint and at joint near spillway crest. e. Area moist - stains not apparent. f. See d. g. Joints deteriorated. h. Back surface eroded. i. None j. Concrete sound but surface soft.
3. Discharge Channel a. Apron b. Stilling Basin c. Channel Floor d. Vegetation e. Seepage f. Obstructions g. General Struct. Condition	3. a. None b. None c. Rock gorge d. Tree in rock right side. e. Seepage from bot. of spillway concrete on left side and possibly right side. f. Clogged with brush, twigs & debris. g. Good but channel requires cleaning.
4. Walls a. Wall Location _____ (1) Vegetation (2) Seepage or Efflorescence (3) Rust or Stains (4) Cracks (5) Condition of Joints (6) Spalls, Voids or Erosion (7) Visible Reinforcement (8) General Struct. Condition	4. a. NA - Rock Gorge
5. Bridge Over Spillway a. Railing b. Decking c. Stringers d. General Struct. Condition	5. a. Timber rails - good condition b. Timber in good condition c. Log stringers - good condition d. Struct. in good condition including painting and appears well maintained.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: McLeod Pond

DATE: 8/22/78

EMBANKMENT: Dike 3

CHECK LIST	CONDITION
1. Upstream Slope a. Vegetation b. Sloughing or Erosion c. Rock Slope Protection - Riprap Failures d. Animal Burrows	1. a. Grass, weeds, ferns, brush b. None observed - irregular c. Irreg. boulder riprap, 6-18" d. None observed
2. Crest a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Movement or Settlement	2. a. Grass & weeds along path b. Irregular, apparently from foot traffic c. None observed d. None apparent - generally irreg.
3. Downstream Slope a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Animal Burrows e. Movement or Cracking near toe f. Unusual Embankment or Downstream Seepage g. Piping or Boils h. Foundation Drainage Features i. Toe Drains	3. a. Grass, brush, weeds, trees - typ. 4'-8" dia., one 24" dia. pine. b. None significant - v. irregular c. None observed d. None observed e. None observed f. None observed g. None observed h. None observed i. None observed
4. General a. Lateral Movement b. Vertical Alignment c. Horizontal Alignment d. Condition at Abutments and at Structures e. Indications of Movement of Structural Items f. Trespassing g. Instrumentation Systems	4. a., b., c. Dike irregular, but no indication of movement, max. crest irregularity $\approx 1'$. d. Merges onto rock @ ends (no structures). e. N.A. f. Path used along crest g. None observed

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: McLeod Pond

DATE: 8/22/78

SPILLWAY: Auxillary Spillway

CHECK LIST	CONDITION
1. Approach Channel a. General Condition b. Obstructions c. Log Boom etc.	1.a. Good condition - weir adjacent to pond. b. None c. None
2. Weir a. Flashboards b. Weir Elev. Control (Gate) c. Vegetation d. Seepage or Efflorescence e. Rust or Stains f. Cracks g. Condition of Joints h. Spalls, Voids or Erosion i. Visible Reinforcement j. General Struct. Condition	2.a. None b. None c. Grass d. Seepage at base of wall e. None observed f. Vert. crack right side g. No joints observed h. 2 spalls on downstream face i. 3/8" bar projecting 3" above crest j. Concrete in good condition
3. Discharge Channel a. Apron b. Stilling Basin c. Channel Floor d. Vegetation e. Seepage f. Obstructions g. General Struct. Condition	3.a. None b. None c. Woodland growth d. See 3c. e. See 2d. f. See 3c. g. There is no formal structure or channel.
4. Walls a. Wall Location _____ (1) Vegetation (2) Seepage or Efflorescence (3) Rust or Stains (4) Cracks (5) Condition of Joints (6) Spalls, Voids or Erosion (7) Visible Reinforcement (8) General Struct. Condition	4. N/A

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: McLeod Pond

DATE: 8/22/78

EMBANKMENT: Dike 4

CHECK LIST	CONDITION
1. Upstream Slope a. Vegetation b. Sloughing or Erosion c. Rock Slope Protection - Riprap Failures. d. Animal Burrows	1. a. None b. None - new fill c. None - loose fill slope d. None
2. Crest a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Movement or Settlement	2. a. None b. None - new fill c. None - new fill d. None observed
3. Downstream Slope a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Animal Burrows e. Movement or Cracking near toe f. Unusual Embankment or Downstream Seepage g. Piping or Boils h. Foundation Drainage Features i. Toe Drains	3. a. Brush & trees below new fill b. None observed c. None - upper slope loose fill d. None observed e. None observed f. None observed g. None observed h. None observed i. None observed
4. General a. Lateral Movement b. Vertical Alignment c. Horizontal Alignment d. Condition at Abutments and at Structures e. Indications of Movement of Structural Items f. Trespassing g. Instrumentation Systems	4. a., b., c. Fill irregular, slopes down & narrows to S. behind concr. wall. d. No obvious abutments (no structures, except for concr. wall which has been cracked into sections, possi- bly by constr. equipment.) e. Concr. wall cracked & displaced up to 1" \pm . f. Path along new fill g. None observed
5. Wall a. General Struct. Condition	5. a. Concrete appears to be same vintage as auxillary spillway concrete. Spans between rock outcrops. 3 large vertical cracks present. Structure appears to be in poor structural condition but present usage appears to be upstream face protection.

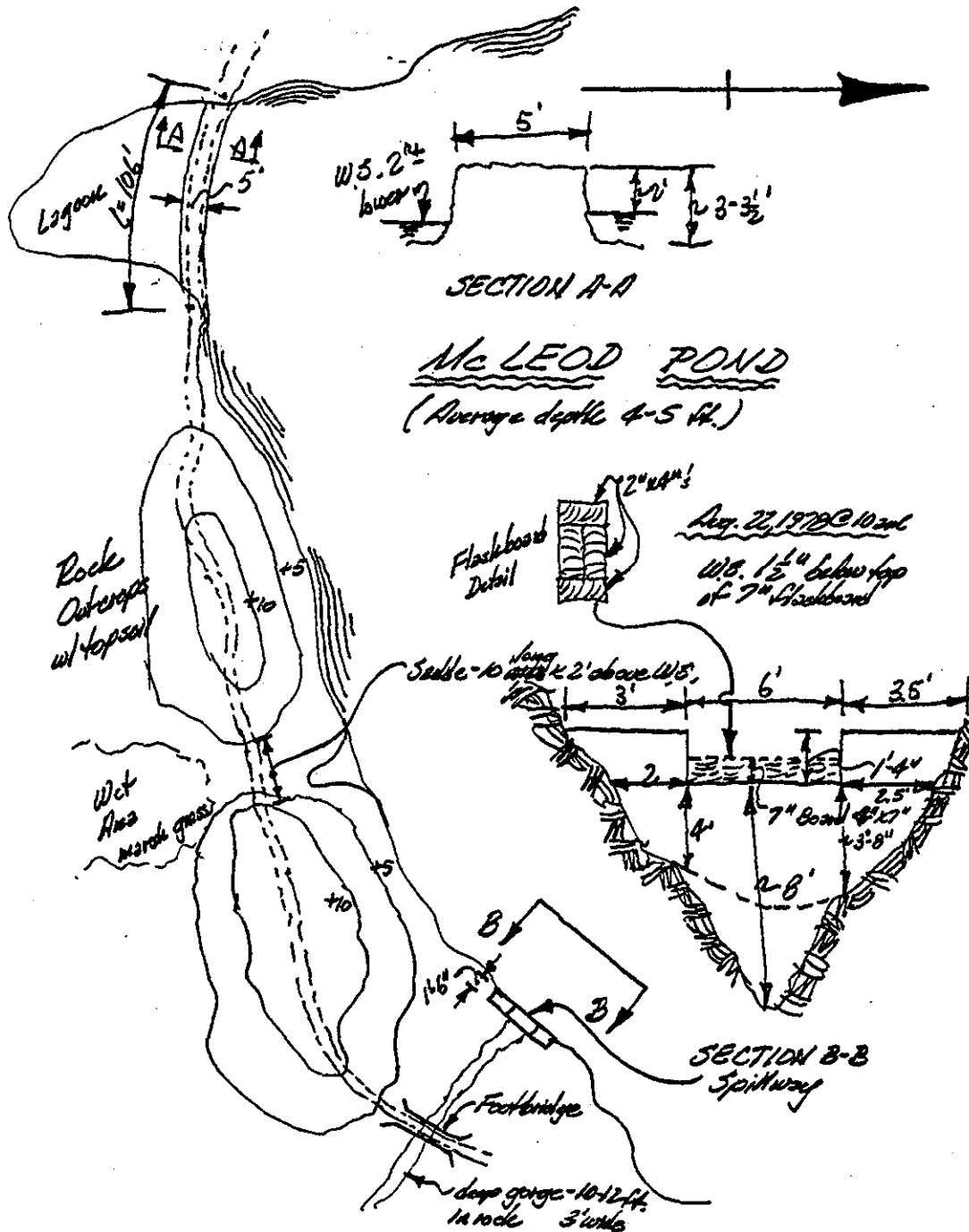
VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

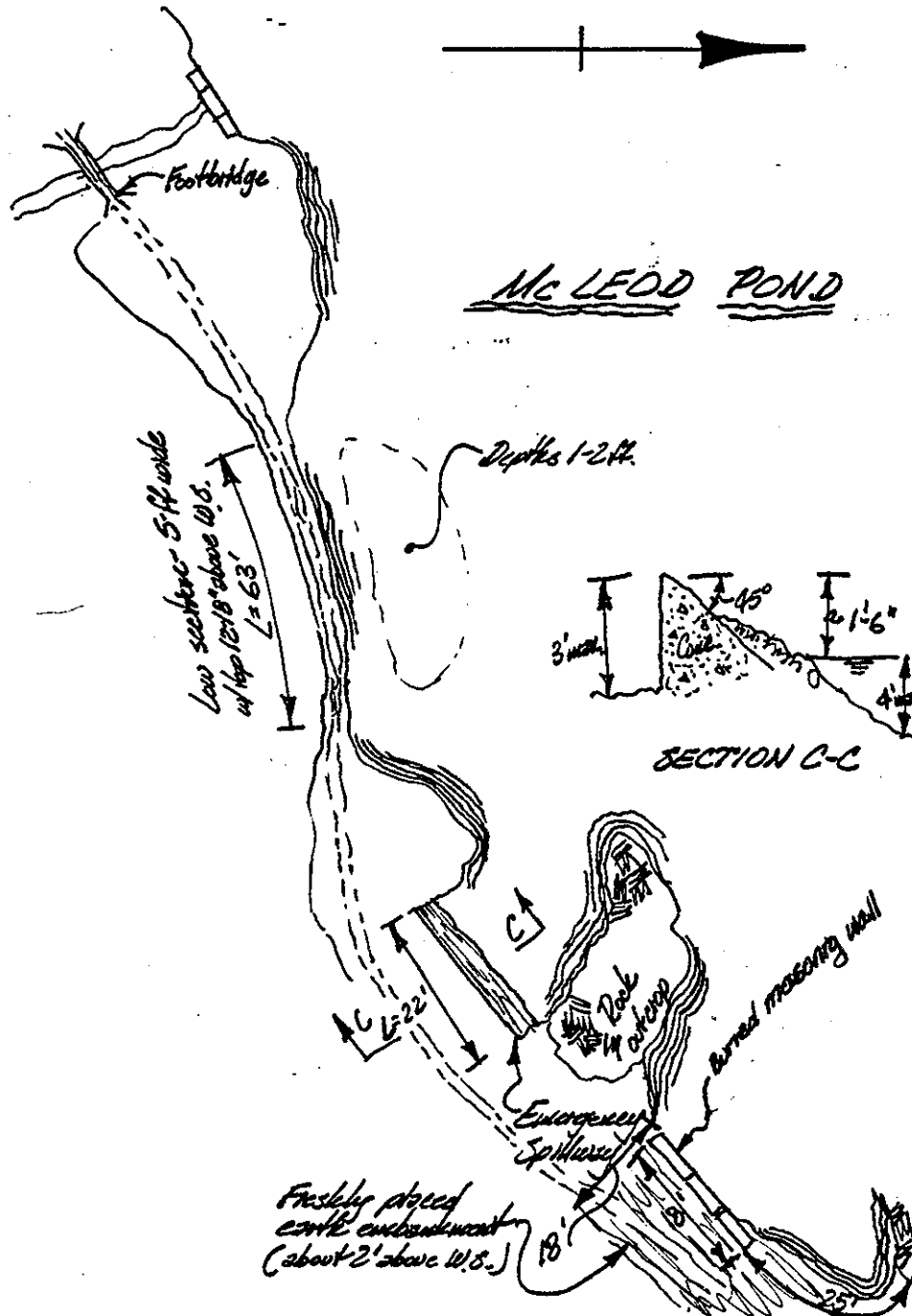
DAM: McLeod Pond

DATE: 8/22/78

HYDROLOGIC-HYDRAULIC CONSIDERATIONS: _____

CHECK LIST	CONDITION
1. Upstream Watershed a. Type of Terrain b. Hydrologic Controls	1. a. Moderate to steep hills (up to 20% slope) Densely wooded. b. None; two inlet streams.
2. Reservoir a. Type of Terrain b. Development	2. a. Moderate to mildly sloped b. None
3. Spillway a. Adjacent Low Points b. Spillway Approach (Slope) c. Spillway Discharge (Slope) d. Spillway Type	3. a.,b.,c. See Sketches d. Concrete
4. Downstream Watershed a. Reach No. 1 (1) Control (Bridge, dam, culvert, etc.) (2) Channel Characteristics (3) Development (4) Visible Utilities (5) Special Problems (Hospital, etc.) b. Reach No. 2	4. a. Meadow Brook - very steep (1) Channel (2) Rocky (3) None (4) None (5) None 4. b. North River (1) Channel (2) Mild slope-sand, gravel, some rock (3) 3 houses on east bank (4) None (5) None





APPENDIX B

LIST OF AVAILABLE DOCUMENTS AND
PRIOR INSPECTION REPORTS

Page No.

LIST OF AVAILABLE DOCUMENTS

None Available

PRIOR INSPECTION REPORTS

DATE

BY

None Available

APPENDIX C

SELECTED PHOTOGRAPHS OF PROJECT

Page No.

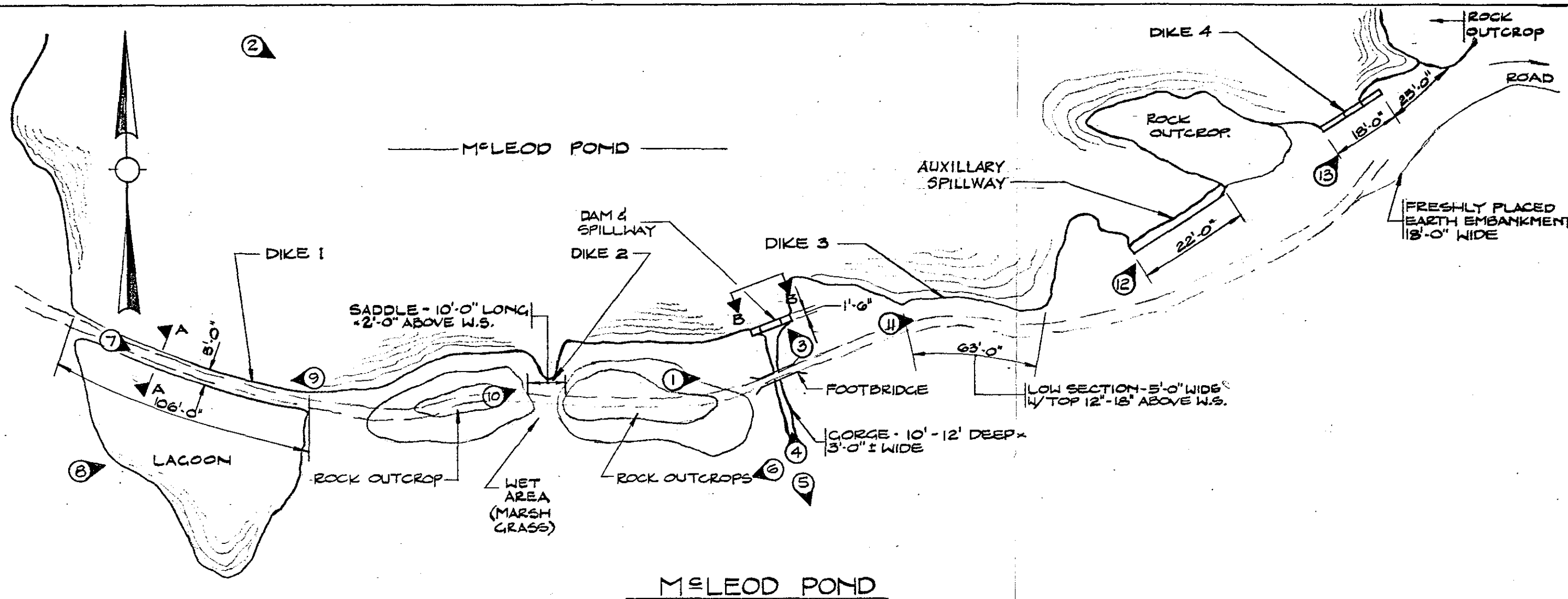
LOCATION PLAN

Location of Photographs

C-1

PHOTOGRAPHS

<u>No.</u>	<u>Title</u>	<u>Page No.</u>
1.	Overview of Dam and Spillway	Follows Table of Contents
2.	Telephone View of Spillway From Across the Pond	C-2
3.	Downstream Face of Spillway	C-2
4.	Downstream Channel Looking Toward Spillway	C-3
5.	Looking Downstream from Rock Gorge Below Spillway	C-3
6.	Overland Seepage from Lagoon Behind Dike No. 1	C-4
7.	Crest of Dike No. 1	C-4
8.	Downstream Face of Dike No. 1 and Lagoon	C-5
9.	Upstream Face of Dike No. 1	C-5
10.	Overview of Dike No. 2 from Right Abutment	C-6
11.	Crest of Dike No. 3	C-6
12.	Downstream Face of Auxiliary Spillway	C-7
13.	Crest of Dike No. 4	C-7



McLEOD POND

NOTES:

1. PLAN SKETCH BASED ON FIELD OBSERVATIONS BY CAMP, DRESSER & MCKEE, INC.
2. ① DENOTES PHOTOGRAPH NUMBER AND DIRECTION OF VIEW.

CAMP DRESSER & MCKEE, INC. BOSTON, MASSACHUSETTS	U.S. ARMY ENGINEER, DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MA.
---	--

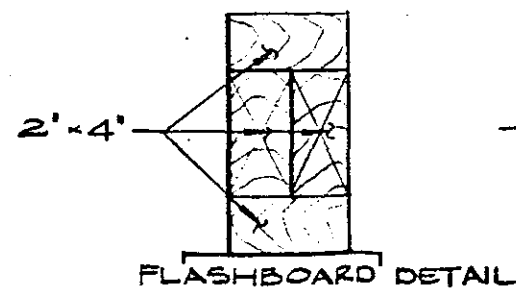
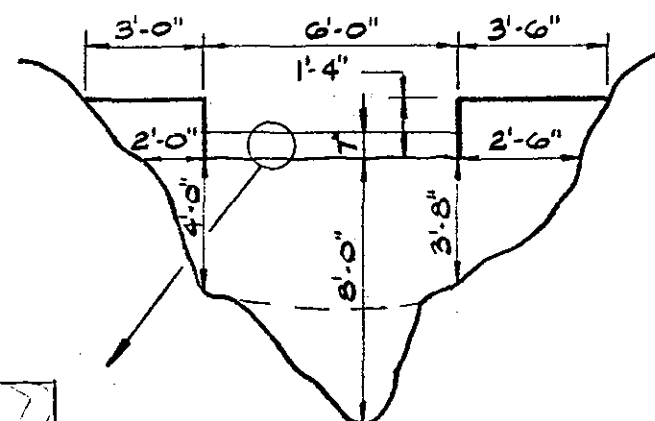
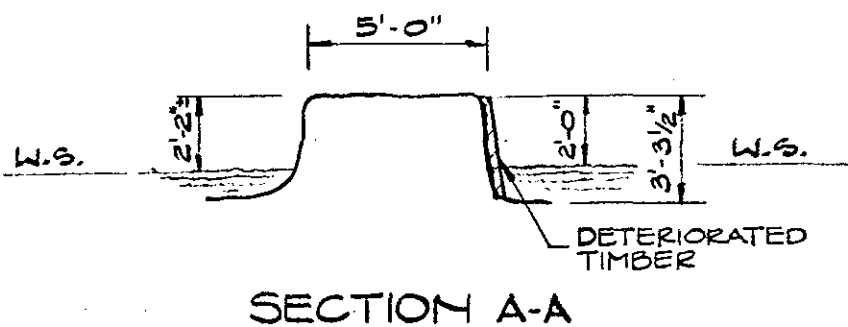
NATIONAL PROGRAM OF INSPECTION OF NON FED. DAMS

MCLEOD DAM SITE PLAN SKETCH

McLEOD POND	MASSACHUSETTS
-------------	---------------

SCALE: NONE
DATE: SEPT. 1978

APPENDIX C-1





2. TELEPHOTO VIEW OF SPILLWAY FROM ACROSS THE POND.



3. DOWNSTREAM FACE OF SPILLWAY.



4. DOWNSTREAM CHANNEL LOOKING TOWARDS SPILLWAY.
NOTE DEBRIS BELOW SPILLWAY WEIR.



5. LOOKING DOWNSTREAM FROM ROCK GORGE BELOW SPILLWAY.



6. OVERLAND SEEPAGE FROM LAGOON BEHIND DIKE NO. 1 TO CHANNEL DOWNSTREAM OF SPILLWAY, VIEW IS LOOKING SOUTH AT END OF ROCK GORGE BELOW SPILLWAY.



7. CREST OF DIKE NO. 1.



8. DOWNSTREAM FACE OF DIKE NO. 1 AND LAGOON BEHIND DIKE.



9. UPSTREAM FACE OF DIKE NO. 1 SHOWING DECAYED TIMBER.



10. OVERVIEW OF DIKE NO. 2 FROM ITS RIGHT ABUTMENT.



11. CREST OF DIKE NO. 3.



12. DOWNSTREAM FACE OF AUXILARY SPILLWAY.



13. CREST OF DIKE NO. 4 SHOWING FRACTURED CONCRETE WALL AT UPSTREAM FACE AND FRESHLY PLACED FILL BEHIND TO FORM A NEW CREST.

APPENDIX D
OUTLINE OF DRAINAGE AREA AND
HYDRAULIC COMPUTATIONS

Page No.

OUTLINE OF DRAINAGE AREA

Drainage Area Map

1

COMPUTATIONS

Size Classification; Hazard Classification

Dam Failure Analysis

2

Dam Failure Analysis - con'td.; Test Flood

3

Determination of Elevations, Surface Areas,
and Storage Capacities

4

Test Flood Inflow Determination

5

Stage - Discharge Relationships

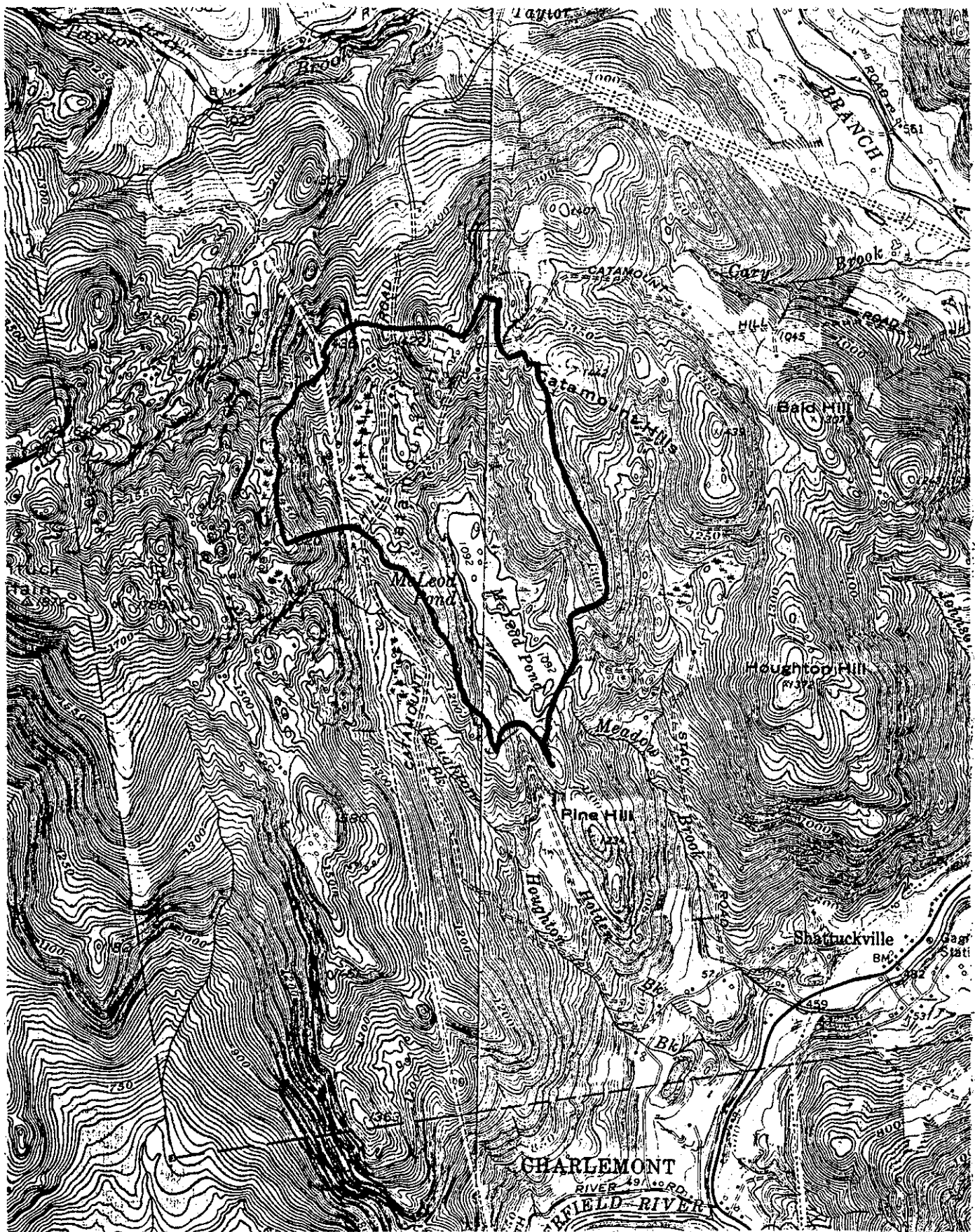
6

Surcharge - Storage Routing

7

Discharge Rating and Storage Rating Curves

8



CAMP DRESSER & McKEE Inc.
Consulting Engineers
Boston, Mass.



McLEOD POND DAM
DRAINAGE AREA MAP
SCALE: 1" = 2000'

SIZE CLASSIFICATION

Maximum Height of earth dikes is ~ 4-ft.

Height of main spillway is ~ 9.5-ft. on downstream face

Estimated Storage @ Top of Dam: 270 ac-ft. (see p. 3 of 8)

∴ Size Classification is SMALL

HAZARD CLASSIFICATION

The potential hazard appears Low as dam is small and there is no development downstream along Meadow Brook — However, there are low lying residences along the North River which may be affected, depending upon the magnitude of a failure. Therefore, Dam Failure Analysis must be performed to determine hazard classification.

DAM FAILURE ANALYSIS

Consider: I - Westerly Earth Dike
II - Main Dike

I - Westerly Dike is ~ 106-ft long x 4-ft high

$$Q_{p1} = 8/27 (106 \times 4) (32.2)^{1/2} (4)^{3/2} = 570 \text{ cfs}$$

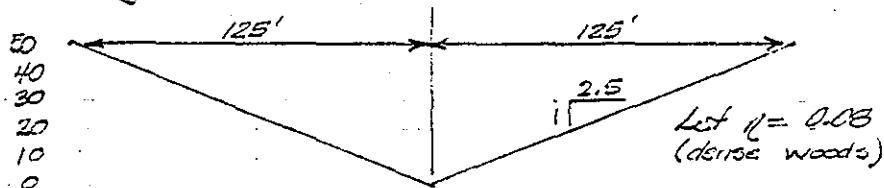
II - Main Spillway - Max. height = 9.5', L = 9.5'

Assume complete failure:

$$Q_{p2} = 8/27 (9.5) (32.2)^{1/2} (9.5)^{3/2} = 470 \text{ cfs}$$

∴ USE $Q_{p1} = 570 \text{ cfs}$

Meadow Brook is quite small (~ 2 to 3-ft wide by < 6" deep)
∴ Use typical overbank cross-section from USGS Quad:



REACH 1 - TYP. X-SECT.

Meadow Brook (cont'd)

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2} \quad \text{where } A = \text{unknown} = 2.5 y^2$$

$$R = \text{unknown} = A / 5.4 y$$

$$S = \text{Ground Slope} = 0.1143$$

$$\text{Let } Y = 1\text{-ft.}; A = 2.5(1)^2 = 2.5; R = 2.5 / (5.4 \times 1) = 0.463$$

$$Q_1 = \frac{1.49}{0.05} (2.5) (0.463)^{2/3} (0.1143)^{1/2} = 10 \text{ cfs}$$

$$\text{Let } Y = 4\text{-ft.}; A = 2.5(4)^2 = 40; R = 40 / (5.4 \times 4) = 1.852$$

$$Q_4 = \frac{1.49}{0.05} (40) (1.852)^{2/3} (0.1143)^{1/2} = 250 \text{ cfs}$$

$$\text{Let } Y = 4.75\text{-ft.}; A = 2.5(4.75)^2 = 56.4; R = 56.4 / (5.4 \times 4.75) = 2.2$$

$$Q_{4.75} = \frac{1.49}{0.05} (56.4) (2.2)^{2/3} (0.1143)^{1/2} = 600 \text{ cfs}$$

Say 570 cfs \rightarrow depth of 4.7-ft.

$$\text{Top width} \approx 4.7 \times 2.5 \times 2 = 24\text{-ft.}$$

Stream length from McLeod Pond to North River
is approx. 1-mile

$$\therefore \text{Vol.} = \frac{56 \times 5250'}{43,560 \text{ sq-ft./ac}} = 6.8 \text{ ac-ft.} \rightarrow \text{negligible}$$

REACH #2 = North River, $Q_p = 570 \text{ cfs}$

From Rating Curve of 1965 Gage No. 01690 @ Shattuckville
on North River which $\sim .5 \text{ mi}$ upstream of confluence
of Meadow Brook, 570 cfs $\rightarrow 4.0 \text{ ft.}$ depth. (E. 462.5 ft)

There are no structures along North River which would be
endangered by a flow of 570 cfs - Normal flows
on North River exceed 570 cfs at least once a month.

TEST FLOOD

Size SMALL & Hazard LOW \rightarrow 50 to 100-YR Frequency

ELEVATIONS:

DATUM: There is no known datum or spillway crest elev's.

USGS Quad (Colrain, Mass.-Yt.) shows McLeod Pond
W.S. & Elev. 1092.0. Assume this elev. to equal
spillway crest.

Then Main spillway crest elev. 1092.0
Top of Flashboards elev. 1092.58
Top of Sidewalls elev. 1093.33
W.S. & Elev. of Insp. 1092.45
Top of Westerly Dike 1094.45
Top of Middle Dike 1093.70
Top of Easterly Dike 1094.45
Top of Aux. Spillway 1094.0

Use Elev. 1094.45 as "Top of Dam"

SURFACE AREAS:

<u>ELEV.</u>	<u>AREA (ACRES)</u>	
1092.0	36.7	} from USGS Quad.
1100.0	56.5	
1110.0	68.9	

STORAGE CAPACITIES:

At spillway crest, El. 1092.0 = $36.7 \times 4.5' = 165 \text{ ac.-ft.}$
avg. pond depth

At Top of Flashboards, El. 1092.58
= $165 + \left(\frac{56.5 - 36.7}{8} \times .58 + 36.7 \right) \times .58$
= $165 + 22 = 187 \text{ ac.-ft.}$

At Aux. Spillway, El. 1094.0
= $165 + \left(\frac{56.5 - 36.7}{8} \times 2.0 + 36.7 \right) \times 2.0$
= $165 + 63 = 248 - \text{Island} = 241 \text{ ac.-ft.}$

At Elev. 1100.0
= $165 + \left[\frac{(56.5 + 36.7)}{2} \right] \times 8.0 = 538 \text{ ac.-ft.}$

At Top of Dam, El. 1094.45
= $165 + \left(\frac{56.5 - 36.7}{8} \times 2.45 + 36.7 \right) \times 2.45$
= $165 + 105 = 270 \text{ ac.-ft.}$

TEST FLOOD DETERMINATION - INFLOW

A. SCS (CN) Equations:

$$Q_p = \frac{484 \times D.A. \times (1 \text{ inch of Runoff})}{T_p}$$

Slope: Length = 4,800 ft.

Elev. @ 85% $\times 4,800' = 5780'$ is 1350.0

Elev. @ 15% $\times 4,800' = 1020'$ is 1092.0

4760 ft 258 ft. Elev. diff.

Slope = $258/4760 = 0.0542 = 5.42\%$

CN { Forest = 355 ac. @ CN = 55 $\rightarrow 19,525$
Pond = 27 ac. @ CN = 100 $\rightarrow 3,700$
Meadow = 18 ac. @ CN = 60 $\rightarrow 1,080$
410 ac. $24,305 \div 410 = 59.3$
say CN = 60

$S = 1000/CN - 10 = 1000/60 - 10 = 6.67$

$Lag = \frac{L^{0.5}(S+1)^{0.7}}{1900 Y^{0.5}} = \frac{(4800)^{0.5}(1+6.67)^{0.7}}{1900 \times (5.42)^{0.5}} = 1.10 \text{ hrs.}$

$T_L = 1.67(1.10) = 1.83 \text{ hrs.}$

$\Delta D = 0.133(1.83) = 0.243 \text{ hrs.}$

$T_p = \Delta D/2 + L = 0.243/2 + 1.10 = 1.22 \text{ hrs.}$

$Q_{50} = (Q_p) \times (\text{depth of Runoff}); 5.7" \text{ Rainfall} \rightarrow 1.72" \text{ Runoff}$
 $= \left(\frac{484 \times 0.64}{1.22} \right) \times 1.72 = 437 \text{ cfs INFLOW}$

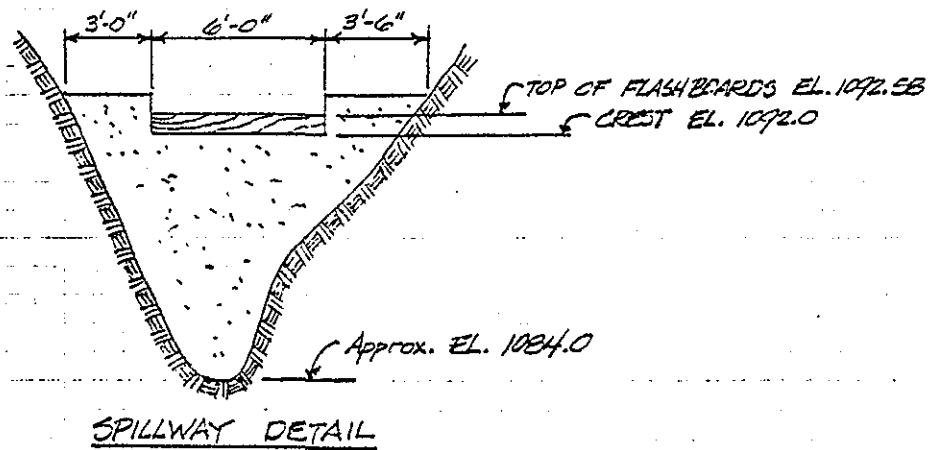
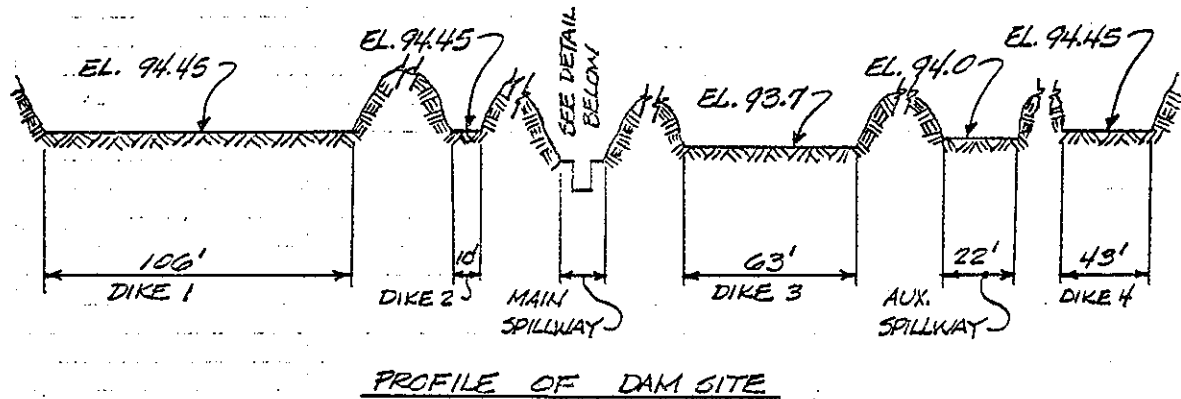
$Q_{100} : 6.3" \text{ Rainfall} \rightarrow 2.11" \text{ Runoff}$
 $= \left(\frac{484 \times 0.64}{1.22} \right) \times 2.11 = 536 \text{ cfs INFLOW}$

B. 1/4 PMF CONCEPT

Extrapolation for Mountainous Terrain:
 $1/4 \text{ PMF} = 1/4 \times 2950 \text{ csm} \times 0.64 \text{ sq. mi.} = 470 \text{ cfs}$

C. TEST FLOOD INFLOW

Since the 1/4 PMF is mid-range between the 50-yr and 100-yr values developed by the SCS Method, it shall be adopted as the TEST FLOOD INFLOW.



STAGE-DISCHARGE RELATIONSHIPS

SECTION ① Dikes 1, 2, & 4: Length = $100 + 10 + 43 = 159'$;
"C" = 2.5
EL. = 1094.45

SECTION ② Main Spillway: Length varies from 6' to 12'-6"
"C" = 3.3
EL. varies from 1092.0 to 1092.55

SECTION ③ Dike 3: Length = 63'; "C" = 2.5; EL. = 1093.7

SECTION ④ Aux. Spillway: Length = 22'; "C" = 3.3; EL. = 1094.0

CAMP DRESSE, I & MCKEE
Environmental Engineers
Boston, Mass.

CLIENT COE
PROJECT DAM INSP.
DETAIL MCLEOD POND

JOB NO. 380-S-RT
DATE CHECKED 2-5-78
CHECKED BY CFW

PAGE 6 of 7
DATE 8-27-78
COMPUTED BY JED

POND ELEV	SECT. ① (cfs)	SECT. ② (cfs)	SECT. ③ (cfs)	SECT. ④ (cfs)	TOTAL (cfs)
1092.58	-	0	-	-	0
1093.33	-	13	-	-	13
1093.70	-	28	0	-	28
1094.00	-	45	26	0	71
1094.45	0	76	102	22	200
1095.00	162	121	234	73	590
1095.50	428	167	380	133	1108

SURCHARGE - STORAGE ROUTING

TEST FLOOD INFLOW = 470 cfs

$$\text{Surcharge } H_1 = 1094.45 + [(470 - 200) / (590 - 200)] \times .55 = 1094.83$$

$$\begin{aligned} \text{STOR}_1 &= 83 + [(538 - 241) / 6] \times 0.83 = 124 \text{ ac.-ft.} \\ &= 124 / (53.3 \times 0.64) = 3.6 \text{ inches} \end{aligned}$$

$$Q_{P2} = 470 \times (1 - 3.6 / 6) = 188 \text{ cfs}$$

$$\text{Surcharge } H_2 = 1094.0 + [(188 - 71) / (200 - 71)] \times (.45) = 1094.41$$

$$\text{STOR}_2 = 83 + [(538 - 241) / 6] \times .41 = 103 \text{ ac.-ft.}$$

$$\text{Avg. STOR} = (103 + 124) / 2 = 110 \text{ or } 110 + 165 = 275 \text{ ac.-ft. Total Storage}$$

$$\text{@ 275 ac.-ft STOR., } H_t = 1094.0 + [(275 - 241) / (538 - 241)] \times 6 = 1094.69$$

$$\text{Discharge @ El. 1094.69} = 200 + [(590 - 200) / .55] \times 0.25 = 370 \text{ cfs}$$

OUTFALL

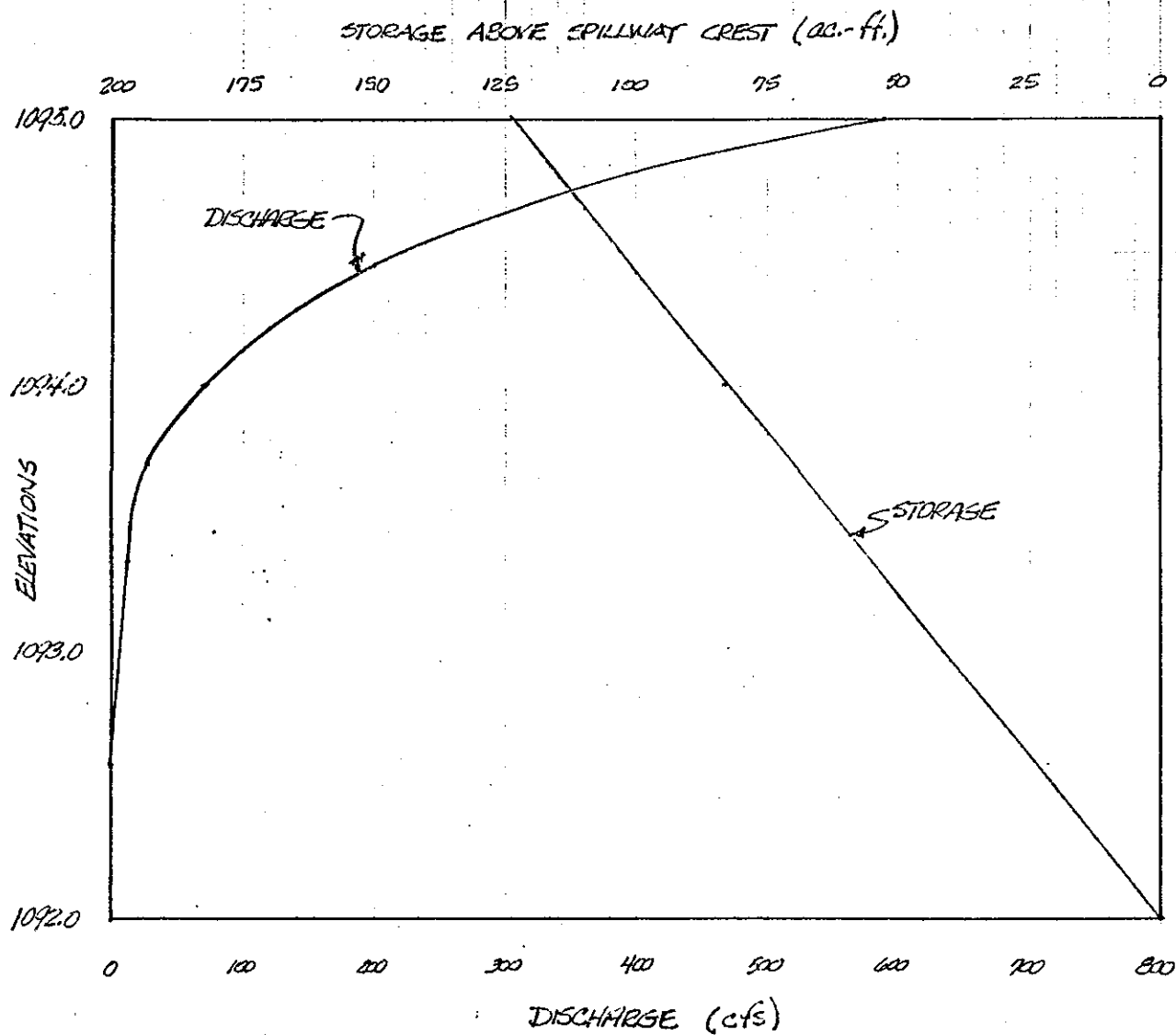
TEST FLOOD OUTFLOW = 370 cfs @ EL. 1094.7

CAMP DRESSER & MCKEE
Environmental Engineers
Boston, Mass.

CLIENT CCE
PROJECT DAW FISHP
DETAIL MALIBU ROAD

JOB NO. 380-5-10
DATE CHECKED _____
CHECKED BY _____

PAGE 7 of 7
DATE 11-30-78
COMPUTED BY JED



APPENDIX D-8

APPENDIX E
INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS

CONNECTICUT RIVER BASIN
COLRAIN, MASSACHUSETTS

McLEOD POND DAM
MA 00046

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

NOVEMBER 1978